

## Dr Aldo R. Castaneda - Apollonian Surgeon Exemplar (1930-2021): An inspiring legacy

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Dr Aldo R Castaneda

Apollonian Surgeon Exemplar (1930-2021)

Dr. Aldo Castaneda is regarded as the father of neonatal cardiac surgery and the founder of the modern cardiac Congenital Heart Surgery Unit.

When he was selected as chief of cardiac surgery at Children's Hospital, Boston, an affiliate of Harvard Medical School, in 1972, succeeding Dr. Robert E. Gross, the father of pediatric cardiac surgery, the field had already taken birth. Controlled cross circulation had given way to the heart lung machine for repair of intra-cardiac defects. Many techniques for correcting specific lesions had already been described, or were constantly being invented.

Dr. Aldo Castaneda's primary contribution involved reorientation of the entire thinking process in the field of pediatric cardiac surgery. First, he started to infuse a

spirit of camaraderie among colleagues and associates. He hit off tremendously with Dr. Alex Nadas, the head of pediatric cardiology and so infectious was their friendship that it spilled over to the remaining staff of surgery and cardiology and to affiliated areas of expertise such as anesthesia, perfusion, intensive care, and cardiac pathology. This was a refreshing change from the not uncommon bitterness and noncooperation between medical and surgical sides in many centers at the time. To this day, pediatric cardiology and cardiac surgery in most units, world over, exhibit cohesion and cooperation and good will toward each other, such was Dr. Castaneda's infectious influence.

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His other contribution was to usher in an era of modernization. Silk sutures gave way to polypropylene in the operating room (OR). Weekly grand rounds, cath meetings, mortality and morbidity meetings, each attended by everybody involved in care of the child with heart ailments. Weekly cardiac pathology classes by Dr. Stella Van Praagh for the trainee surgeons were the most popular. Each of Stella's classes would start with her bringing forth a dish she would herself have baked "to wake up the tired surgical residents" in an absolutely informal spirit. Nursing began to occupy prime place in patient care and nursing input was given great importance by him and other surgical faculty.

Dr. Castaneda believed firmly in the physiologic superiority of early primary repair of congenital heart disease and was principally opposed to palliative procedures for most lesions. Moreover, it was not as if this was introduced later. In fact, research into deep hypothermic circulatory arrest went hand in hand very early after his joining Boston Children's and prospective trials on neurological consequences were initiated then and the initial cohort is being followed up to this day. The fact that he had been considering this revolutionary concept is clear from his experimental work when he was at the University of Minnesota where he had studied the comparative behavior of 2 kg pups with larger subjects, to different durations of cardiopulmonary bypass and noted equivalent outcomes. This was soon extended to early complete repair of tetralogy of Fallot, first in infancy, and then in the <3-month age group, and finally, in the neonatal age group.

His philosophy of early repair found perfect synergy in the surgery for transposition of the great arteries (TGA) with intact ventricular septum (IVS). Based on pathological specimens demonstrating equal thickness of the right ventricular and left ventricular free walls, and the knowledge that both the ventricles supported the systemic circulation prior to birth, Dr. Castaneda hypothesized the feasibility of anatomical repair of TGA IVS early after birth. So far, the arterial switch operation had worked for TGA only in the presence of a large ventricular defect that served to keep the left ventricle exposed to high pressure. The 1<sup>st</sup> month of life was arbitrarily selected as cutoff. In an interview later, he narrates the story of the first child selected to undergo the arterial switch in the neonatal age group. The father happened to be an engineering graduate at MIT. When explained the possible advantages of anatomical repair versus a physiological repair with its well-known mid- and long-term problems, he readily gave consent for the arterial switch, even though his child was going to be the first in the world to undergo testing of the hypothesis. And purely on engineering grounds!

Thirteen of the 14 neonates reported in the first publication on clinical experience with neonatal arterial

switch operation had successful outcome with one of the neonates weighing only 1.8 Kg! "We were lucky" he said with characteristic humility, in a subsequent interview.

The publication of the report, in 1983, on neonatal primary arterial switch operation for TGA IVS, catapulted Children's hospital, Boston into a completely different orbit, in the world of congenital heart surgery.

This proof of concept was followed by another giant stride for surgery for TGA IVS who presented late with regressed left ventricles. A presentation by a cardiologist colleague, Dr. Nadal, wherein he had demonstrated rapid left ventricular hypertrophy, within a matter of days as a response to surgically created coarctation of the aorta in an animal model, prompted Dr. Castaneda to raise the question of whether this could be extrapolated to the situation of the left ventricle following a pulmonary artery band in a TGA IVS with regressed left ventricle. Till then, only delayed left ventricular preparation (interval period about 9 months) had been proven by Prof. Magdi Yacoub in 1977, but had its drawbacks. Successful arterial switch operation 2–10 days after the first stage gave rise to the rapid 2 stage arterial switch, popularized by Dr. Richard Jonas, of the same unit.

Under Dr. Castaneda, Boston became the Mecca of arterial switch operation not just for TGA IVS, but, because of their excellent published outcomes, for all TGA corrections, all over the world.

During the same period Dr. Castaneda provided full support to another colleague, Dr. William Norwood, in his development of the Stage I repair for hypoplastic left heart syndrome (HLHS). In his own words, the difference here was that there was nothing to lose, as HLHS is uniformly lethal untreated, while physiological repair of TGA carried only a 2% early mortality in those days, compared to unknown outcomes with the "experimental" arterial switch operation. The Norwood operation had a long learning curve, but the boss never wavered in his support, notwithstanding the hiccups.

I had the good fortune of being a fellow under Dr. Castaneda at Boston Children's, in 1989, after completion of my MCh. As I started my fellowship, not having surgical magnification loupes was a constraint to be the first assistant or to be allowed to operate. Dr. Castaneda ensured a made-to-order set of loops were ordered and delivered in no time, completely free of cost. A fluent and quick surgeon, he was always exhorting the operating team members not to waste bypass and clamp time, albeit in a humorous manner. It should not "look like you are making love to the heart. You need to be quick in, do what is necessary, and out you go," he told us fellows and residents, stressing on the importance of speed. He had devised his own remedies for situations that resulted in reproducibility

and prevention of time-consuming complications, for example, the back wall of the neo-aorta in the arterial switch would always be sutured in the double layer to prevent bleeding.

He had unique surgical style, which many of us surgeons tried to imitate: He would follow his own suture when closing a right atriotomy. Another Step I found interesting was that he would never tie surgical knots with a single hand using fingers, as most surgeons do. Rather, he would tie knots using both hands (as one ties laces), but with no loss of speed.

Dr. Castaneda possessed great sense of humor and would often narrate stories from his extensive experience or discuss some news or philosophical topic with his assistants and anesthesia staff, while he moved swiftly through the operation.

The same sense of urgency went into the intensive care unit (ICU). He did not like patients remaining on ventilator for multiple days postsurgery. "If he could breathe before surgery and is unable to breathe after, it's the operation that is at fault" was his approach. No blame was ever laid on the resident on duty or the nurse looking after the child, in the event of a patient not doing well. Any difficulty in weaning the ventilator, the first suspicion would be the quality of the operation and would prompt an evaluation by echocardiogram and, more often than not, re-catheterization. If any significant defect was found, prompt reoperation would follow. Any patient with a fresh Blalock shunt not getting off ventilator, would be sent back to OR for reduction of the shunt size, with presumed diagnosis of pulmonary overflow. Once a week ICU grand rounds with all surgeons and allied specialties in attendance, were routine, and a fountain of knowledge for aspiring surgeons like me. It was in these rounds in 1989 where, seeing the obvious smoothness of recovery of a Fontan staged through a prior Glenn shunt compared to primary Fontan that the idea of fenestrating electively was floated and came into mainstream for all intracardiac total cavopulmonary connections.

Dr. Aldo Castaneda was profuse in praise and acknowledged a new idea or technique, unhesitatingly. An incident stands out in my memory. During my days at Children's, Prof. Venugopal, my Chief at my alma mater, attended Sunday grand ICU rounds. There was a postoperative Fontan patient who was exhibiting arterial desaturation of recent onset (this was prior to the fenestration era). Dr. Venugopal raised the possibility of pulmonary thromboembolism. Dr. Castaneda promptly ordered a right heart re-catheterization which, sure enough, showed abrupt cut off in some peripheral pulmonary arteries. Initiation of heparin solved the problem. The coming Tuesday, in the cath meeting, when the patient was presented, Dr. Castaneda rose to acknowledge

Dr. Venugopal's suggestion and his gratitude for helping the patient. In another incident, on a visit to the All India Institute of Medical Sciences, New Delhi, in 1990, he was demonstrating the arterial switch operation with Dr. Bhaba Das (then additional professor CTVS, AIIMS). He was pleasantly surprised to see the latter's superb assistance and his unique style of holding both limbs of the suture taut, while the second bite was being taken at a bleeding point. Later, in his talk that followed, he acknowledged this and his mental note of including this method in the surgical repertoire when he returned home.

Dr. Aldo Castaneda retired from Boston Children's hospital in 1995. Although most surgeons would retire to a life of comfort after such an illustrious career, he chose to continue his surgical work to alleviate suffering of little children afflicted by heart ailments. After spending a few years setting up a unit in Genolier, Switzerland, he returned to Guatemala, his country of origin. It was a heartfelt gesture, as Guatemala at that time had no pediatric cardiac care unit. As in any developing country, congenital heart disease was not the priority of government health care. Dr. Castaneda single handedly set up the Unidad Cardiovascular de Guatemala (UNICAR), arranged for funds by setting up a foundation, starting with 1 OR, 2 ICU beds, and 6 ward bed units. They were able to conduct more than 1300 operations in the first 6 years. It was a hand to mouth existence and the unit was threatened by multiple near closures for shortage of funds. Yet, he continued with his policy of not denying treatment to any child who entered its gates. Today, there are 3 full time surgeons and till last report some years back, 5000 surgeries had been done.

Dr. Castaneda served as the 74<sup>th</sup> president of the American Association for Thoracic Surgery (AATS) (1993–1994). He was the 8<sup>th</sup> recipient of the AATS' and also of the American College of Cardiology's lifetime achievement award. Among other awards and honours, he received the Order of the Quetzal and the Order of Afanacio Tzul by the Guatemalan government, the WHO humanitarian award and was a member of more than 20 professional societies and has over 370 publications.

What gave rise to such a fascinating achiever, yet such a giving personality?

Perhaps the formative years hold the answer:

Born to Central and South American parents in Italy in 1930, the family migrated to Germany where his father pursued medical studies. However, his parents separated, and young Aldo stayed with his mother and grandmother. Primary schooling was in Munich. World War II had set 'in' 1939, and they remained trapped in Nazi Germany. Many nights were spent in underground shelters during the bombings. He finally graduated in 1950 from Switzerland after doing a course in humanities that would leave a

lasting impression on him. During this time, he came across an article in New England Journal of Medicine about the status of heart surgery and being deeply influenced, joined medical school at the University of San Carlos, Guatemala, in 1951. He was a distinguished student and during medical school conducted medical research on dogs putting them on cardiopulmonary bypass using a bubble oxygenator. With this background, he was accepted at the University of Minnesota, the birthplace of open intracardiac repair, under Dr. Owen H. Wangensteen. Following a stint in the research lab, he completed his surgical training and then joined the faculty. Here he progressed rapidly to the rank of professor in 1970 by sheer dint of his surgical skills and knowledge.

Dr. Castaneda's adieu to the planet on April 30, 2021 came as a shock to all members of the fraternity, his patients, and their families. He is survived by his wife and three children.

In his presidential address to the AATS in 1994 entitled "The making of a cardiothoracic surgeon: An Apollonian

quest," Dr. Castaneda spelt out his concept of the complete cardiothoracic surgeon-one who is not only technically sound and knowledgeable, but also who has the interest of his patients foremost in his heart. In his mind, cardiac surgery was a highly moral obligation. In his life and career, he truly embodied one.

Today, nearly 50 units performing pediatric cardiac surgery all over the world are headed by trainees of Dr. Aldo Castaneda.

The Aldo Castaneda Society now continues as the World Society of Congenital Cardiology and Cardiac Surgery and continues his motto of treatment to all children with congenital heart disease irrespective of origin, race, and economic status.

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